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CEMENTITIOUS COMPOSITIONS CONTAINING ACRYLIC ESTER POLYMERS

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This invention relates to an acid-resistant cementitious material, to the manner of compounding it, and to the manner of using it, particularly a cementitious material of this kind containing a polymeric latex.

This application is a continuation-in-part of my co-pending application Serial No. 796,199, filed March 2, 1959, now abandoned, which is a continuation-in-part of my application Serial No. 517,903, filed June 24, 1955, now abandoned.

Cementitious materials incorporating polymeric latices have been known in the past. In general, however, such latices have been based on natural rubbers, on more or less related rubber-like substances of natural origin, or on synthetic resins having physical properties akin to those of natural rubber such, for example, as the polyacrylonitriles. Cementitious materials containing such latices have developed fair strengths in thin layers but as a rule have had poor working characteristics and have not adhered well to other materials. The disadvantages have tended to outweigh the advantages with the result that in the past only rather limited use has been made of cementitious materials containing such latices.

More recently, cementitious materials have been made incorporating vinyl polymers and copolymers, particularly polyvinyl acetate. Such compositions, whether used in surfacing new floors, mending existing concrete surfaces, or making joints between blocks, give products having reasonably good strengths but poor resistance to water, aqueous processing media, and acids of the kinds commonly met with in industrial practice. Experiments with cementitious materials so made up are reported in "Industrial and Engineering Chemistry," April 1953, page 759 et seq. The reported data establish that exposure to moisture is deleterious, due apparently to the relative ease with which polyvinyl acetate is affected by water.

The polymers used in the cementitious composition of the present invention function quite differently from polymers of vinyl acetate because they react with the calcium of the cement to provide a chemical bond. Apparently, the acrylate groups of the polymer, which are less stable toward hydrolysis than methacrylate groups, hydrolyze to form an alcohol and to form an acrylic acid group on the polymer chain which reacts with the calcium of the cement to increase the strength of the concrete as disclosed, for example, in the article by Gerould Allen appearing at pages 1661 to 1665 of "Official Digest," December 1959. Because of this chemical bonding, it is desirable to use a relatively large amount of cement and a polymer formed predominantly of ethyl acrylate or other alkyl acrylate to obtain the maximum advantages of the invention (for example, when making concrete floors). In the case of cementitious compositions employing polyvinyl acetate, any hydrolysis of the acetate groups of the polymer leaves on the backbone of the polymer alcohol groups which cannot react with the calcium of the cement to form a stable chemical bond.

For special purposes, cementitious materials of the nature of slurries have been heretofore devised incorporating water-soluble salts of polyacrylic acid and the partially hydrolyzed polyacrylamids. Such slurries, which are described in Lea Patent 2,614,998, granted October 21, 1952, are said to be characterized by a low water loss and by a retarded set. By virtue of these attributes, the slurries

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are said to be usable for grouting cracks in masonry structures and in cementing oil wells, where there is a tendency for a slurry to lose water to such an extent that the cementitious material becomes prematurely dehydrated, set or cracked. These deficiencies are attributed to incomplete hydration of the cement, which, it is said, may be minimized by incorporating in the cement a solution of a water-soluble synthetic resin.

It is an object of the present invention to provide an acid-resistant cementitious material containing a commercial latex derived from a water-insoluble synthetic resin, which cementitious material, in its more dilute forms, lends itself to use as an adhesive, masonry paint, grout or the like. In such dilute forms, the cementitious material may to advantage be composed largely or entirely of finely divided hydraulic pigments or the like, and a minor amount of a commercial polyacrylate latex derived from one or more water-insoluble monomers, such as 2-ethyl hexyl acrylate or ethyl acrylate, and having a low glass transition temperature. As will appear, cementitious materials of this type are susceptible of a wide variety of uses. Detailed examples of such uses, together with preferred compositions, are given below.

A further object of the invention is to provide a more concentrated material of the same general type that is usable in the same way as ordinary cementitious mixtures for forming poured floors, walls, ceilings, etc.

Still a further object of the invention has to do with the use of a still more concentrated material in the form of a paste, mortar or patching cement. In this form, the invention may be utilized to good advantage to repair damage in pre-existing structures such, for example, as a concrete sidewalk, floor, ceiling or the like. In general, sidewalks, floors and ceilings of concrete are subject to premature deterioration due to the effects of such factors as their poor resistance to abrasion, spalling under atmospheric influences, and a susceptibility to damage by chemicals. According to methods known prior to this invention, the repair of deteriorated concrete surfaces was time consuming, expensive and often unsatisfactory, the latter partly because of a failure to bring about adequate adhesion between old and new materials. The present invention obviates these disadvantages by providing a cementitious material which is easy to apply, which adheres well, and which in general stands up at least as well as the original material.

Still a further object of the present invention is to provide a cementitious material which, in use, is not readily susceptible to leaching out, to hydrolysis by aqueous media, or to corrosive attack by acids such as lactic acid, citric acid and various other acids, organic and inorganic, of the types encountered in industry. These acids are not usually regarded as strong acids; however, they are responsible for much damage in dairies, food canneries, bottling plants, etc. To minimize damage of this sort, the invention makes use of a commercial latex derived from a water-insoluble polyacrylate in the cementitious material of which the floors, walls, ceilings, etc. are formed.

Another object of the invention is to provide a cementitious composition of a consistency lending itself to working without using excessive amounts of water so that maximum strength may be obtained in the resulting concrete or cementitious coating.

Other objects, advantages and features of the invention will be apparent from the following description, which includes a variety of illustrative examples.

In all of the various forms which the cementitious materials of the invention may take, a finely divided cement is one of the ingredients. In every case the cement is one of the types that are referred collectively to in the cement art as "hydraulic cements." Included are all